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IMPERIAL MYCOLOGICAL
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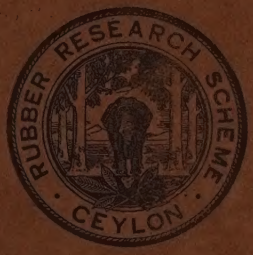

November, 1934.

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REGISTRATION FOR PUBLICATIONS OF THE RUBBER RESEARCH SCHEME (CEYLON.)

Bulletins, Quarterly Circulars and Leaflets published by the Rubber Research Scheme are issued without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of Rubber Estates in Ceylon who apply for their names to be registered for the purpose. Registration must be renewed at the beginning of each year.

Application for registration for 1935 should be made on the attached form and forwarded to the undersigned.

Culloden,
Neboda,
December 20th, 1934.

T. E. H. O'BRIEN,
Director of Research,
Rubber Research Scheme (Ceylon.)

Registration for Publications of the Rubber Research Scheme (Ceylon.)

To

The Director of Research,
Rubber Research Scheme (Ceylon.)
Culloden,
Neboda.

Please register my name for issue of publications of the Rubber Research Scheme (Ceylon) during 1935,

Name.....

Address.....

.....

Qualification for Registration :.....

FIELD EXPERIMENTS ON DARTONFIELD ESTATE.—I. REPLANTING

R. K. S. MURRAY, A.R.C. Sc.,

BOTANIST AND MYCOLOGIST,

RUBBER RESEARCH SCHEME (CEYLON)

A comprehensive programme of field experiments, embracing investigations on all the agricultural problems of major importance in connection with mature Rubber, has been devised for execution on the Scheme's recently acquired Dartonfield Estate. In order to keep the general planting public in touch with the progress of these investigations from the start it is proposed to follow the somewhat unusual course of giving a brief account of the objects and design of each experiments as and when it is initiated. The results will be published periodically as they become of sufficient interest.

The present report deals with an experiment on replanting procedure.

SITE OF EXPERIMENT

The area selected for this series of comparisons is an isolated field of about 7½ acres. The field is typical of a Kalutara estate, both moderately steep and gently undulating land being represented. Most of the land is very stony, and soil conditions may be regarded as average. The original stand of trees was established in 1913 at the rate of 114 to the acre, the growth and yield being somewhat above the average for this type of land.

Circumstances rendered it impossible to carry out any drastic tapping trials before the trees were felled.

DESIGN OF EXPERIMENT

The experiment provides for the following comparisons:

(a) *Removal of Timber.*—Comparison of costs, growth and disease incidence with the following treatments, all trees being felled by elephant:

α Leaving large timber lying unburnt.

β Burning all timber *in situ.*

γ As β, but removing and burning all large lateral roots.

(b) *Species of Cover Crops.*

(1) *Centrosema pubescens.*

(2) *Pueraria phaseoloides.*

(3) *Calopogonium mucunoides.*

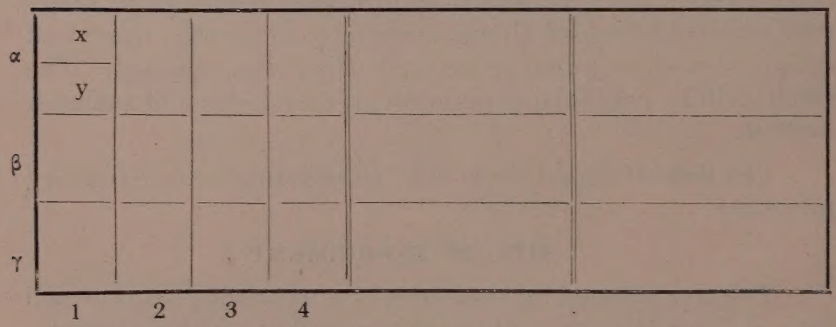
(4) *Dolichos Hosei* (Vigna).

(c) *Control of Cover Crops.*

x Keeping platforms clean weeded.

y Allowing cover to grow on platforms except for a 6 feet circle to be kept clean round each plant.

The layout is as shown in the diagram:



There are three blocks (replications), each of which is divided into three plots for treatments α, β, γ, and into four strips at right angles to these plots for treatments 1, 2, 3 and 4. Each sub-plot is again divided into two for the treatments x and y. With the planting density employed the smallest unit area comprises 8 trees, all plants on the outside of the field being excluded from the plots. The treatments are separately randomised in each replication.

In addition to the direct comparisons in the three different series it will also be possible by statistical methods to compute

the various interactions between the disposal of timber and the control and species of cover crops. For example, the data will show whether one species of ground cover needs to be more stringently controlled than another.

A different clone is being used in each block, the three clones selected being:

Glenshiel I
Prang Besar 186
A.V.R.O.S. 256

This will only provide data for a general comparison between the clones.

PROGRESS TO DATE

The progress of the various replanting operations up to the end of September, 1934, is summarised in the following notes, the works being in most cases considered in the order in which they were carried out. The object of this information being to give representative details and costs of replanting procedure for the interest of estate Superintendents contemplating this work, the exact costs incurred in this experiment are not given where they differ markedly from normal estate figures. Under "Weeding", for example, it has been necessary to remove the *Vigna* which was formerly growing under the old stand from the strips in which pure covers of *Centrosema*, *Pueraria* and *Calopogonium* are required. In other directions, also, costs have been somewhat high owing to the exigencies of the experimental treatments. At the end of these notes an estimate of first year replanting costs is given, the actual expenditure incurred in this experiment being modified where deemed necessary.

Lining and Holing.—Commenced 27th November, 1933.

Owing to the layout of the experimental cover crop strips it was necessary to maintain rows in at least one direction. The old Rubber was planted in well-defined rows 20 ft. apart, and the direction of these rows was followed in lining for the new holes, the lining rope being placed exactly half way between the old rows. The new planting distance is the same as the old, *i.e.*, 20 feet × 19 feet, giving a stand of about 114 trees to the acre. This stand is possibly rather low for initial planting in estate practice, but is suitable for the purposes of the experiment.

The cost of the lining, including pegs but not the lining rope was slightly under Rs. 2·00 per acre.

Holes were dug 3 feet × 2 feet × 3 feet deep on contract at 10 cents per hole.

Dynamiting.—Commenced 28th December, 1933.

Any hole which could not be dug to the required depth on account of hard cabook or partially decomposed rock, or whose bottom could not easily be loosened with an alavango, was dynamited. It was found necessary to blast 371 out of a total of 842 holes. Half a cartridge was sufficient for most holes, but in a few instances two or even three half-charges were necessary.

The total inclusive cost was 21·7 cents per hole, or Rs. 10/73 per acre over the whole area.

Felling.—Commenced 12th January, 1934.

The work of felling by elephant was given out on contract at -/15 cents per tree, including the preliminary cutting of side roots. This figure is considered to be somewhat high owing to the difficulty of fixing a contract with so small an area. The cost, however, will vary greatly in different localities according to the rate at which a good elephant is procurable. If a large area is to be replanted it would be advisable to commence felling in November or December of the old year.

Cutting, Stacking and Burning.—Commenced 24th January, 1934.

Side branches were first cut and stacked, the smaller wood being placed at the bottom of the stacks to facilitate subsequent burning. During this work the opportunity may be taken of throwing green twigs and leaves into the open holes. Except in the plots where the larger timber was to be left lying, the main trunks were then cut into lengths of 10-12 feet and levered on to the stacks. A cross-cut saw was first used for cutting the trunks, but this was subsequently found unnecessary except for the largest trees. Burning gave trouble owing to the advent of rains just when the stacks were ready, and in one plot was not completed till July.

For various reasons, largely connected with the necessity for adopting different treatments in the various experimental plots, the costs of cutting, stacking and burning were unduly high. Rs. 25·00 per acre is probably an average figure for a stand of 80-100 trees.

The actual cost of cutting and stacking the large timber was $10\frac{1}{2}$ cents per tree. This does not, however, represent the total difference between treatments α and β since it does not include the extra cost of burning. Unless this experiment indicates any advantage in leaving the large timber lying unburnt, one would advise burning as much as possible.

Removing Lateral Roots.—Commenced 23rd February, 1934.

In accordance with the experimental treatments, lateral roots were removed over one-third of the area. This was done by elephant, a chain being placed round the exposed end of the root and the root thus pulled out of the ground. The roots, being fresh, came out quite cleanly, seldom breaking off at a thickness of much more than an inch. If root disease were known to be present the smaller extremities would have to be forked out of the ground, but otherwise this method seems quite satisfactory if the removal of the greater proportion of the old roots is deemed desirable. Information on this point is, of course, one of the aims of the experiment.

The work was given out on contract at 12 cents per tree.

Filling Holes.—Commenced 22nd February, 1934.

This work was started immediately after the first burn. The best possible top soil was scraped off the land, and mixed with wood ash and half a sack per hole of fallen Rubber leaves fetched from other portions of the estate. Any available green leafy material may also be mixed with the soil to advantage. This work, being one of the most important of the early replanting operations, received very careful supervision.

The cost was 10·6 cents per hole.

Cutting Platforms.—Commenced 3rd March, 1934.

This work was started as soon as the land was sufficiently cleared of timber. Owing to the necessity for planting in rows it was impossible to cut continuous platforms on the contour, and an individual platform had accordingly to be cut for each tree. The platforms were cut 15 feet long, the back being measured 4 feet from the peg. An earth bund 6-12 inches high was built at the front and sides of each platform.

The cost was 36 cents per platform, or about Rs. 40·00 per acre.

This method of planting in rows in conjunction with individual contour platforms would not be recommended for ordinary estate procedure except possibly on gently undulating land.

Repairs to Platforms.—Within a few days of completion of the platforms exceptionally heavy rain was experienced, over 18 inches falling in three successive days. Considerable damage was done to the platforms, mainly on account of surface and seepage water from a jungle hill immediately above the clearing. Further damage was caused by heavy monsoon rains early in June.

The total sum spent on repairs to platforms amounted to Rs. 12·77 per acre. Although this is an abnormally high figure, some provision should always be made for this contingency since heavy rains are likely to occur early in May before the platforms have consolidated.

Forking Platforms.—Commenced 25th May, 1934.

Every platform was deep forked in order to aid percolation before the onset of the monsoon rains. It is now considered that it might be preferable to cut a silt-pit at the back of each platform, thus fulfilling a similar function in increasing the water-holding capacity, and postpone the forking until later in the year when green manure loppings will be available.

The cost of the forking was Rs. 1·74 per acre.

Cover Crops and Green Manures.—Commenced sowing 19th April, 1934.

The procedure and costs of planting ground covers in this field have little relation to ordinary estate practice, as it was necessary to establish each of four species in three defined strips. The former cover of Vigna was left in the desired strips and weeded out of the others. *Centrosema* and *Calopogonium* were each planted by seed at the rate of about 5 lb. per acre. An attempt was made to plant *Pueraria* by cuttings, but owing to the onset of dry weather within a few days of planting most of the cuttings failed to strike. The strips were later sown with seed at the rate of about 2½ lb. per acre.

Crotalaria anagyroides was also sown throughout the field at the rate of 1 lb. per acre, and a hedge of *Clitoria laurifolia* was established on the outside of each platform. At the time of writing this report (October) the *Crotalaria* bushes are ready to be lopped.

Weeding.—Commenced 27th April, 1934.

As mentioned above the costs of weeding this field are abnormally high owing to the necessity for keeping 12 plots each with a pure cover of one particular species.

Planting and Upkeep of Budgrafts.—Commenced 13th June, 1934.

The field was planted in the middle of June with budded stumps taken from a nursery at Nivitigalakele. Favourable planting weather was experienced until early in July when a spell of dry weather intervened which lasted until the end of September. When taken from the nursery the plants were stumped at 3 feet, and the ends waxed, and stock shoots were allowed to grow in the field until the beginning of September. All plants were then cut back to 6 ins. from the bud in order to force the latter to shoot. A census taken at this time revealed 43 casualties (about 5 per cent.), and these were supplied late in September. A further census on the 10th October showed that about 40 per cent. of the buds had sprouted, and that 7 more buds had died.

The total proportion of deaths at the date of writing is therefore about 6 per cent. In view of the dry weather experienced from July to September this figure must be regarded as satisfactorily low and is mainly attributed to the high quality of the stumps used. Apart from suitable planting weather, vigorous growth of the nursery plants is probably the most potent factor influencing the success of the planting operations. The postponement of the final cutting back until the root system has become well established in its new environment is also considered desirable. It may be mentioned that after drawing the stumps from the nursery the lateral roots should not be cut back to the stump, but a length of at least 6 inches should be allowed to remain.

The planting operation cost 2·3 cents per plant. The stumps were charged at 16 cents each, this being calculated as the cost price of one successfully budded stump in the Nivitigalakele nursery (including all costs except budwood).

Each plant has been provided with a bamboo basket @ 6 cents to give protection against hare, etc., and to encourage vertical growth of the young shoot.

Drains.—After the heavy rains experienced in May the necessity of keeping open certain leading drains was realised. This involved the removal of a number of individual plants, but fortunately the disposition of the experimental plots was not seriously affected. When replanting steep land it is undoubtedly necessary to keep the main ravines open. Platforms built across them will be destroyed in the first big storm.

Paths and Steps.—A sum of Rs. 5·00 per acre was estimated for building inspection paths and steps, of which Rs. 2·25 had been spent at the end of September. Rs. 2·50 per acre is probably sufficient for a clearing opened with continuous contour platforms.

Fencing.—It is essential to surround a replanted clearing with a barbed wire fence if there is any possibility of cattle trespass. The actual expenditure in fencing the clearing in question was very high, partly because of the large boundary in relation to the area enclosed and partly because iron posts were used. Using *milla* posts, the cost for a large clearing would probably amount to about Rs. 15·00 per acre.

The following is a suggested estimate of representative costs incurred in the first year of replanting, the figures being based on the experience of the above operations.

	Costs per acre. Rs. cts.
Supervision, including opening fees. ...	20·00
Lining.	2·00
Holing 3 feet × 2 feet × 3 feet at 120 per acre.	12·00
Dynamiting where necessary.	10·00
Felling, Cutting, Stacking and Burning. ...	37·00
Filling Holes.	12·00
Cutting Platforms.	45·00
Repairs to Platforms.	2·00
Silt-Pits in Platforms.	5·00
Forking Platforms.	2·50
Budded Stumps, Initial Cost and Upkeep. ...	25·00
Planting and Supplying.	4·00
Cover Crops and Green Manures. ...	5·00
Weeding.	10·00
Paths and Steps.	2·50
Tools.	5·00
Fencing.	15·00
	Rs. 214·00

NOTES ON THE MANUFACTURE OF RUBBER GOODS IN CEYLON.

M. W. PHILPOTT, M. Sc., A.I.R.I.

CHEMIST, RUBBER RESEARCH SCHEME (CEYLON)

CONSIDERABLE interest has lately been shown in the possibilites of the development of new industries in Ceylon and the opinion is held by many that the rubber manufacturing industry has claims to consideration in this respect. To transfer the manufacture of rubber goods from the so-called industrial countries to the countries where the raw material is produced seems to be a logical and rational development and it is perhaps worth while examining briefly the implications of such a proposal.

The idea of setting out to manufacture rubber goods in Ceylon is not a new one. As early as 1918 a factory in Colombo was actually manufacturing on a large scale railway fittings, such as rolling rings, valves, and vacuum brake fittings for the Indian railways. It is understood that this factory was equipped with unsuitable and obsolete plant and that this fact militated against the reduction of manufacturing costs to an economic level. The enterprise ultimately was forced to close down in the face of fierce competition, but not before it had been proved, according to the sponsors of the venture, that conditions in Ceylon are not incompatible with the establishment of a local manufacturing industry. It is claimed that if sufficient additional capital had been forthcoming for the purchase of new and up-to-date machinery it would have been possible to compete in the Indian market with goods from England and Japan. At the time when this capital was required, however, Ceylon was suffering from a severe trade depression and it was impossible to interest investors in the project.

It should be borne in mind that in the last few years advances have been made in rubber technology that have somewhat altered the complexion of the situation regarding the production of vulcanised rubber goods. Before discussing the

nature of these advances it might be well to enquire briefly into some of the factors that would have a bearing on local manufacturing by orthodox or "classical" methods. These factors will be grouped under the four headings: plant, materials, power and labour.

PLANT

The plant requirements depend largely on the type of work contemplated. There are, however, certain machines that are common to nearly all classes of manufacture and these would almost certainly have to be imported from abroad. Masticating machines, mixers and calenders are essential to any manufacturing process in which dry crude rubber is the raw material, and in the great majority of processes hydraulic vulcanising presses, autoclaves and extruding machines must be added to the list. All these units are specialised and expensive machines and although the modern latex technique, to which reference will be made later, renders some of them unnecessary, it is true to say that for ordinary rubber manufacturing the provision of a certain amount of rather costly plant is unavoidable.

MATERIALS

Under the Restriction Scheme the price of rubber for internal consumption would be substantially below the external price and this would be a very important consideration in favour of the establishment of a local industry.

In the ordinary manufacture of rubber goods, raw rubber is compounded with vulcanising and preserving chemicals with mineral reinforcing agents, fillers, pigments, dyes and sometimes with vegetable fibres. The proportion of rubber to other ingredients in a rubber compound varies over a wide range according to the purpose for which the compound is intended. A high grade inner tube, for example, may have a rubber content in the region of 90 per cent. while the compound from which a tyre tread is constructed will contain about 60 or 65 per cent. of rubber the balance being made up chiefly of carbon black and vulcanising chemicals. Many other types of manufactured goods on the other hand do not contain more than 20 or 25 per cent. of rubber.

For vulcanising chemicals, dyes and mineral fillers, Ceylon would necessarily be dependent on external supplies. The clay that is found in many parts of the Island might be found to be a

suitable compounding ingredient, but so far as is known this question has not yet been investigated. With regard to fillers of a vegetable origin, Ceylon is more favourably situated. For example, the coir residue of the coconut industry which at present is a waste product might prove to be a cheap and useful filler. Preliminary trials have indicated that it undoubtedly has possibilities in this direction. Other vegetable materials such as jute and bagasse that are produced not in Ceylon but in India or neighbouring countries might also be considered as possible materials for use in conjunction with rubber.

POWER

Under this heading is included heating. Orthodox manufacture demands mechanical power to masticate and mix the rubber and also steam for vulcanisation. These two items together constitute a not inconsiderable factor in the cost of manufacture of rubber goods. For the generation of steam, Ceylon would be dependent on imported coal which would probably be supplied from South India. A more substantial item would be the cost of electrical power for the mastication, mixing and calendering processes. With electric power at its present price this cost would be comparatively high, but by the adoption of low temperature vulcanisation methods and by the direct use of latex, both these items might be minimised.

LABOUR

Under adequate supervision local labour should be quite capable of undertaking the ordinary operations involved in manufacturing most types of rubber goods. It would probably be inadvisable to attempt the local manufacture of goods such as pneumatic tyres requiring a large proportion of highly skilled operatives. There is no reason however why local labour should not be able, with a moderate amount of training, to carry out the operations of mixing, calendering, moulding and vulcanising as satisfactorily as European labour. With regard to labour costs, Ceylon is clearly in a strong position in comparison with the Western industrial countries.

The bulk of the foregoing remarks refer to rubber manufacturing as it is generally understood by orthodox or classical methods. In the past few years developments have taken place in rubber technology and advances have been made in our knowledge of the fundamental processes involved in manufacturing that have gone far to modify the position regarding the possibilities of manufacturing.

The first of these developments is connected with the treatment to which nearly all rubber goods are subjected, namely vulcanisation. Vulcanisation is the process that restores to plasticised rubber its strength and elastic qualities and renders it resistant to ordinary atmospheric changes in temperature. Although the nature of vulcanisation is imperfectly understood it may be regarded for practical purposes as being brought about by the action of sulphur on rubber usually at a high temperature. One of the important developments of the last decade has been in the extension of the use of certain chemicals, known as accelerators, that make it possible to bring about vulcanisation in a small fraction of the time formerly required or at a lower temperature. Instead of having to heat rubber and sulphur say for $1\frac{1}{2}$ hours at 140°C. one can complete the process in 5 minutes, or less if desired, with the aid of an accelerator. Or alternatively the temperature at which vulcanisation is carried out may be substantially reduced; indeed it is now practicable to effect vulcanisation without the external application of heat at all but merely by allowing the rubber to "mature" at ordinary temperatures. This method of vulcanisation is not general, however, and would not be applicable, for example, to moulded goods; but in the production of floor coverings, proofings, etc., it might be employed to good advantage.

Another and perhaps more important advance in rubber technology is the development of the direct utilisation of latex. Until comparatively recently little was known about the properties of latex apart from its behaviour in relation to its conversion into dry raw rubber. Its value to the manufacturer as a raw material is even now difficult to estimate but there is no doubt that every year its field of application is becoming wider and its characteristics better understood. It may perhaps be necessary to add that the latex technique is by no means universally applicable and that there still remain, and in the writer's opinion there always will remain, many classes of manufacture to which the newer practice cannot be applied. One of the advantages of using latex rather than crepe or sheet depends on the fact that rubber in the dry form must first be plasticised on heavy and costly machines that absorb a considerable amount of mechanical power. In the production of goods direct from latex, on the other hand, much can be done with the aid of simple and inexpensive plant.

The problem of the transport of latex from the East to Europe and America is one that has not yet been completely solved. It is still not uncommon for latex to arrive in London in a discoloured, unstable or even coagulated condition. No such difficulties need arise with latex for internal consumption, as it would be possible to use the latex a few days after tapping. There are certain differences in the behaviour of freshly preserved and old latex that would require to be carefully studied, but on the whole it may safely be said that fresh latex, on account of its greater stability, would present fewer difficulties to the manufacturer than old latex.

At this stage it might be well to refer to the question of controlling manufacturing processes. It cannot be too strongly emphasised that for the successful conduct of any rubber manufacturing process, careful and accurate control of conditions is essential. Not only must the operations of milling, compounding and vulcanisation be rigidly regulated, but the final product must be constantly checked by the application of suitable tests. To take one example of the sort of trouble that is likely to arise through inadequate scientific control, it sometimes happens that a mineral filler or pigment will confer very poor ageing properties on the rubber with which it is compounded. If such a material were used in large scale production without first submitting it to suitable tests, the final product might be found to be completely useless and unmarketable.

With regard to the quantity of rubber that a local manufacturing industry could be expected to consume, it is unlikely that the establishment of such an industry would be attended by an appreciable increase in consumption. Any manufacturing in the East only transfers activity from one place to another and does not represent additional consumption. Moreover it is improbable that a local industry could absorb more than a very small fraction of Ceylon's total output of raw rubber. It will not be denied that an annual production, say, of a million square yards of rubber flooring would be a very considerable output for Ceylon and yet this would account for little more than 1 per cent. of Ceylon's raw rubber production.

No attempt has been made in these notes to examine the commercial aspect of a possible local industry. It would be necessary to consider carefully the extent of the Ceylon market for rubber goods, and the potentialities of the Indian and other markets.

To summarise these notes it may be said that there is not a clear case either for or against local manufacturing. At the present time the raw material is available at about half its world price and this fact would confer upon the local user a very considerable advantage. On the other hand all the non-rubber materials of manufacture, with a few possible exceptions, would have to be imported, and the cost of power is high. Technically, it would appear that the prospects for successful and economic production in Ceylon are not less but rather more favourable than they have been in the past on account of changes that have taken place in technique and advances in knowledge. While there appears to be no reason why the well established methods of rubber manufacture should not be worked satisfactorily, there are other methods applicable to certain classes of work which are probably better adapted to conditions in Ceylon. Intending manufacturers would be well advised not to attempt at first those classes of work such as tyre manufacture that call for long experience on the part of the operatives: to make full use of the newer technique involving the direct use of latex: to exploit the methods of low-temperature vulcanisation: and to make use wherever possible of local materials. It is the policy of the Research Scheme to direct part of its activities towards the selection by experiment of classes of work that could be confidently recommended for consideration by prospective local manufacturers. To this end, a portion of the Research Scheme's new factory and laboratory at Dartonfield Estate will be equipped with experimental manufacturing plant and devoted to the investigation of problems associated with the local production of rubber goods. Should any of the lines of investigation appear to merit further development, it is proposed to instal larger-scale plant and to follow up the knowledge gained in the laboratory by demonstrations on a semi-production scale. If it is shown that certain classes of goods can be profitably manufactured under local conditions, it will then be for commercial interests to decide whether economic and other considerations justify an attempt to establish a new industry.

"BOILED" CREPE

G. MARTIN, B.Sc., A.I.C., F.I.R.I.,
AND
W. S. DAVEY, B.Sc., A.I.C., F.I.R.I.,

OF THE SCIENTIFIC STAFF OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON & MALAYA)

IN order to obtain a light-coloured crepe it is the practice on an estate in Ceylon to soak the freshly-creped coagulum in hot water for 10 minutes before passing through the smooth rollers. This is a method of obtaining pale rubber which was recommended by Kelway Bamber (1908) and used on some estates for a time but was generally abandoned after the introduction of sodium bisulphite. On the estate referred to the boiling process is combined with the addition of bisulphite with a view to ensuring the preparation of crepe with a satisfactory pale colour.

Some years ago de Vries, Eaton and Stevens all suggested that the hot water treatment was harmful to the rubber as there was a small loss of tensile strength when the rubber was vulcanised in a pure rubber-sulphur mixing. The mixings used in the rubber industry have undergone important modifications and methods of testing have been improved so that the data from which these investigators drew their conclusion would now be regarded as inadequate. A preliminary examination in London of rubber from the estate which had continued the hot water treatment, indicated that it was of satisfactory quality and that it had advantages over crepe prepared without the treatment in question. As the method appeared to be useful for estates which experienced difficulty in preparing crepe with a satisfactory colour owing to adverse climatic conditions, etc., a more detailed examination of specially prepared samples was undertaken. Four sets of samples were prepared at intervals, the first two by the estate Superintendent and the others by Mr. O'Brien. The first three sets consisted of samples prepared on a small scale and were examined by the staff of the London Advisory

Committee. The final set was prepared on a much larger scale and the rubber submitted to four manufacturers who each submitted it to tests determined by the type of goods manufactured.

The samples prepared on the estate were coagulated with acetic and formic acid respectively and consisted of samples submitted to hot water treatment and samples without this treatment. The small-scale samples prepared by Mr. O'Brien were obtained to determine the effect of bisulphite and rolling in conjunction with different periods and temperatures of immersion in hot water. The samples supplied to rubber manufacturers were submitted to the hot water treatment and contained bisulphite, but less than that usually employed in estate practice.

PLASTICITY

In all cases the hot water treatment produced a softer rubber and one which masticated more easily than the control. This was observed in tests in the laboratories of the London Advisory Committee and also by manufacturers. The extent of the softening corresponded to a reduction in time of mastication up to 20 per cent., but manufacturers expressed the opinion that the increase in plasticity was not sufficient to justify a premium. As some manufacturers experience difficulty in manipulating occasional consignments of crepe which cause loss owing to the disturbance of manufacturing schedule, it was suggested by the staff of the London Advisory Committee that the hot water treatment might obviate these occasional consignments of hard crepe. Manufacturers who were consulted on the matter stated that this could only be determined by experience. The regular purchase of supplies of crepe treated with hot water and the maintenance of records over a long period are however not easily arranged. It is difficult therefore to pursue the matter further, except in so far as the opportunity may occur to refer manufacturers who make definite complaints concerning the hardness of crepe to estates which find it convenient to adopt the hot water treatment.

VULCANISATION AND AGEING IN A RUBBER-SULPHUR MIXING

When vulcanised in a rubber-sulphur mixing to a satisfactory technical condition for ageing, the samples treated with hot water required about 10 per cent. longer vulcanisation than their controls and were about 15 per cent. weaker when tested about 24 hours after vulcanisation. On artificially ageing for a

short period however the samples treated with hot water were as strong as their controls and retained a good tensile strength for approximately the same further period of artificial ageing.

The weakness of the rubber in this mixing is not important unless it is also displayed in technical mixings. Moreover the improvement obtained on artificially ageing for a short period tends to nullify adverse criticism of the rubber due to its initial weakness in a pure rubber-sulphur mixing.

VULCANISATION IN ACCELERATOR MIXING

The tests carried out in the laboratories of the London Advisory Committee indicated that in some circumstances the rubber treated with hot water did not give good results owing to the low acid value referred to in connection with chemical tests below. On the addition of stearic acid results as satisfactory as those given by the control were obtained. Most manufacturing mixings contain stearic acid, and it does not appear necessary to increase the amount normally employed, and the rubber may be regarded therefore as satisfactory. This is confirmed by the report of one manufacturer who stated that "there appeared to be no essential need for the introduction of additional stearic acid for vulcanisation purposes."

Some of the manufacturers referred to the slow curing properties of the rubber when tested in the mixings employed by them. This was not observed in tests in the Committee's laboratories in mixings containing accelerator and stearic acid, but it is evidently not of considerable importance as all the manufacturers agreed that the rubber had satisfactory mechanical properties on vulcanisation and aged well.

CHEMICAL TEST

The preliminary samples were submitted to analytical tests with a view to obtaining information of practical value in connection with the utilisation of rubber.

The samples treated with hot water absorbed about 20 per cent. less moisture from a damp atmosphere than the controls and are therefore likely to be more suitable for the electrical industries than standard crepe and sheet.

In view of the importance of fatty acids in connection with the vulcanisation of the rubber in many mixings the acid value of all the samples was determined and the samples treated with

hot water were found to contain less than half the amount of fatty acid contained in the controls. The effect of the treatment on the amount of fatty acids in rubber is surprising as those usually present are not appreciably soluble in water.

The same results were obtained in Ceylon with freshly prepared samples showing conclusively that the low acid values found in London are not due to changes in the rubber in the interval between preparation and examination. The low acid value of rubber prepared by treating the coagulum for a short period with hot water is of considerable theoretical and practical interest (particularly as crepe dried in hot air does not exhibit this deficiency), and is worthy of further study when an opportunity occurs.

ELECTRICAL PROPERTIES

The electrical properties of the rubber after vulcanisation were thoroughly studied by one manufacturer who found that the rubber was equal to smoked sheet.

SUMMARY

The important differences between crepe treated with hot water and the corresponding control prepared without this treatment are:

(1) The rubber treated with hot water is softer than the control and requires up to about 20 per cent. less mastication.

(2) It has a low tensile strength in a rubber-sulphur mixing soon after vulcanisation, but on artificially ageing for a short period the tensile strength of the rubber is as good as that of the control and is maintained for as long a period.

(3) It vulcanises satisfactorily in accelerator mixings containing normal amounts of stearic acid and has good tensile and ageing properties. In some mixings it may be a little slower curing than the control.

(4) It has satisfactory electrical properties.

(5) It absorbs about 20 per cent. less moisture from a damp atmosphere than the control and has less than half the usual acid value.

CONCLUSION

Rubber prepared by treating creped coagulum with hot water may have advantages to estates which have difficulty in preparing crepe of good colour. The quality of the rubber differs in some respects from that of normal estate crepe but is on the whole satisfactory. In some respects the rubber has advantages but not sufficient to justify a premium.

MEMORANDUM ON THE POLICY AND WORK OF THE RUBBER RESEARCH SCHEME (CEYLON)*

T. E. H. O'BRIEN, M.Sc., F.I.C., F.I.R.I.,
DIRECTOR OF RESEARCH,
RUBBER RESEARCH SCHEME (CEYLON)

I am very glad to have an opportunity of submitting to this very representative meeting of agriculturists a short account of the policy and work of the Rubber Research Scheme

The Research Scheme as at present constituted was established by Ordinance No. 10 of 1930. The Board of Management comprising representatives of the Treasury, State Council, Planters' Association of Ceylon, Ceylon Estates Proprietary Association, Low-Country Products Association, Rubber Growers' Association and Small-holders, under the Chairmanship of the Director of Agriculture, met for the first time in December, 1930, so the Scheme has been in active being for 3½ years.

It may be well to remind the meeting that this period has coincided with the unprecedented slump in world trade and the comparatively even greater depression in the rubber producing industry. When the Ordinance was drafted it was anticipated that the income of the Scheme, derived from an export cess of ⅛ cent per lb. of rubber, would be based on exports of the order of 75,000 tons per annum, representing an income of some two lakhs. As members will be aware there have been times during the past 2 years when the level of production has fallen to barely half this figure and there were fears of even greater curtailment. Thus when the Board of Management came to consider proposals for the development of research it was faced with complete uncertainty regarding the future level of income and wisely refrained from becoming involved in a rapid scheme of development, for which funds might prove to be insufficient. The steady improvement in conditions during the past 12 months has enabled the Board to undertake a modest scheme of development but the recently introduced restriction scheme will again have the effect of curtailing our income.

At the time of the establishment of the present Research Scheme there was a body of the same name in existence, financed partly by voluntary subscription and partly by a *pro rata* contribution from Government, which had carried on research for a number of years. This paper does not include

* Submitted to the Board of Agriculture at a meeting held on May 10, 1934 reported in "*The Tropical Agriculturist*" July 1934.

any account of the accomplishments of the old Research Scheme. As was intended by those responsible for framing the Ordinance, the old Research Scheme handed over its staff, buildings and other assets to the new Board of Management. The technical staff thus taken over consisted of myself as Chemist, Mr. R. K. S. Murray as Mycologist, and Mr. W. I. Pieris as Agricultural Assistant. These officers have constituted the Staff of the Rubber Research Scheme until this week when it has been augmented by the arrival of an additional Chemist, Mr. M. W. Philpott. The buildings and other assets handed over comprised laboratories and living quarters at Culloden Estate, Neboda and an experiment station of 70 acres at Matugama.

The lines of work which the Research Scheme is intended to deal with are laid down in the Ordinance as follows: "..... in particular the growth and cultivation of Rubber plants, the prevention and cure of diseases blights and pests, the processes for the treatment of rubber latex and the conversion of such latex into marketable rubber and the utilisation, marketing and disposal of rubber and in general of all products derived from rubber plants.

Another relevant paragraph states that "the Board shall, by the provision and publication of information as well as by advice and demonstration and the inspection of plantations, give practical assistance to persons engaged in the rubber industry."

Before discussing the policy of the Research Board in furthering these objects and the progress which has been made up to the present I should like to point out that a small rubber producing industry such as that of Ceylon is faced by as many problems as a major producing country such as Malaya but it is obvious that the funds available for research will be proportionately smaller. It is therefore essential that a small organisation such as ours should concentrate mainly on problems which are of special local importance, while keeping in close touch with work or problems of more general application carried out in larger centres.

It has been necessary for the Board to consider the orientation of research in relation to this principle and also in relation to the economic position of the industry in general and to decide on the extent to which attention should be given to the branches of research usually known as "Production" and "Consumption" research respectively. Realising that Ceylon is behind other producing countries in agricultural work, more especially in regard to the improvement of planting material by budgrafting and selection, it was considered essential that this type of work should be continued and it has therefore been the policy of the Research Scheme to maintain a balance between agricultural research and work on promoting the utilisation of rubber.

The work and proposals of the Research Scheme may now be considered under the following headings:

1. Agricultural problems.
2. Pests and Diseases.
3. The Manufacture and Utilisation of rubber.
4. Advisory services.

1. AGRICULTURAL PROBLEMS

It has been recognised that there is little scope in Ceylon for the extension of the area under rubber by new planting and that attention must mainly be centred on the maintenance and improvement of existing areas and the possibilities of replanting with improved material. The importance of work on budgrafting and selection lies in its relation to replanting.

The Research Scheme has recently purchased Dartonfield Estate, a property consisting of 170 acres of mature rubber near Agalawatte, where it is proposed to carry out field trials on tapping systems, manuring, soil conservation and replanting. All field trials will be laid out on modern lines, which enable the results to be examined mathematically and their accuracy to be assessed. A replanting experiment, covering an area of 7 acres, has been undertaken this year for the purpose of investigating the effect of different methods of clearing the land on the growth of the new stand of trees and the incidence of disease, and the effect of different species of cover crops and methods of control on growth. The area is being planted with budgrafts of 3 proved imported clones.

The Experiment Station at Nivitigalakele, Matugama, (about 5 miles by road from Dartonfield) which was taken over from the old Research Scheme, comprises an area of 70 acres and has mainly been utilised for testing the value of high yielding Ceylon trees as "mother trees" for the supply of budwood; or in other words as a testing station for Ceylon "clones". The procedure adopted is to establish in the field, buddings from high yielding estate trees, which are selected on the basis of yield records supplied by the estate concerned, in conjunction with bark examination and inspection of the trees by a research officer. It is well known that only a small proportion of trees transmit their high yielding capacity to their budded offspring. It is therefore necessary to wait until the buddings reach tappable size and to assess the value of the clone by test-tapping conducted over a period of several years, together with observations of growth and other characteristics. The first buddings at Nivitigalakele were made in 1927 and some 500 trees are at present under test-tapping. Budwood from an additional 200 mother trees of which about 100 are considered to be of outstanding promise, is established in the budwood nursery, awaiting trial in the field as soon as land is available for the purpose. Application has been made to Government for 100 acres of forest land adjacent to the Experiment Station for this purpose and to accommodate plants derived from pedigree seed.

Experiments on plant breeding by artificial cross-pollination of trees of different clones are being undertaken as the trees become sufficiently mature to produce flowers. Up to the present only a few pedigree seedlings have been obtained from local material owing to the immaturity of the trees and interference with flowering by *Oidium*. Experiments have also been undertaken at Nivitigalakele on the technique of budding and the after-treatment of the budded plants, and provision is made for giving instruction in budding to estate employees.

A nursery was established in 1932 to provide material for the distribution of budded plants of proved clones to peasant proprietors at a nominal price. The nursery is at present being budded and several thousand plants will be available for distribution, either this year as dormant

stumps or next year as grown stumps. The position regarding issue of the plants will be somewhat complicated by the provisions of the Restriction Scheme. It is also proposed to cater for the supply of material to small capitalists when facilities are available for planting more extensive nurseries.

During the past 2 years considerable interest has been taken in tapping systems and a number of estates have adopted various modifications of a system under which 2 half-spiral cuts are made on opposite sides of the tree. In the absence of facilities up to the present for starting our own field trials of the systems the Research Scheme has kept in touch with the subject by means of observations on and reports from estates. A questionnaire was issued last year and resulted in valuable information being received from 82 estates. A report on the subject was published in the Scheme's *3rd Quarterly Circular* for 1933 and a further questionnaire has just been issued. The Research Scheme is collaborating in two estate experiments designed to compare one of the systems with alternate daily tapping and it is hoped to initiate a comprehensive tapping experiment at Dartonfield within the next few months. It should be mentioned that it will take a number of years to make a final assessment of the merits of different systems.

2. PESTS AND DISEASES

The subject which has received most attention under this heading since the inauguration of the Research Scheme is the leaf-fall caused by *Oidium Heveae*. This disease, which was first reported in Ceylon in 1925, has caused comparatively little damage in low-country districts until the present wintering season but at mid-country elevations, where climatic conditions are favourable to the fungus, it has caused widespread damage on a steadily increasing scale.

The Research Scheme collected information on the distribution and effects of *Oidium* by means of questionnaires in 1928 and 1929. In the latter year an experiment was undertaken in the Matale district to ascertain the effects of manuring in preventing the disease. Two heavy applications of nitrogenous and potassic fertilisers were given to the experimental areas but the results in preventing leaf-fall were entirely negative. A trial was also made of liquid spraying with a soluble sulphur mixture but this treatment was replaced in the following year by dusting with fine sulphur powder by means of a portable motor dusting machine. Trials have now been made in 5 successive seasons and the conclusion reached that most of the defoliation can be prevented by sulphur dusting. The treatment is reasonably inexpensive and is considered to be suitable for adoption on an estate scale, in spite of certain practical difficulties.

Future work on *Oidium* is to be discussed at the next meeting of the Research Board but in the meantime it may be said that the main requirement at the present time appears to be to familiarize producers with the recognised method of control, by means of demonstrations in different districts. Improvements in the technique of the dusting operation can best be studied in collaboration with estates undertaking routine dusting operations.

Other subjects which have received the attention of the Mycologist relate to the incidence of *Fomes* in replanted areas, the occurrence of a disease caused by a *Phytophthora* on young budgrafts, the disinfection of

imported planting material, sun-scorch of budgrafts, the prevention and treatment of disease at the point of union of buddings etc.

3. THE MANUFACTURE AND UTILISATION OF RUBBER

I will not take up much time in dealing with the position in regard to normal methods of rubber manufacture. As a result of work carried out by the old Research Scheme and in other countries I think we are in a position to supply any information required by estates relating to ordinary methods of manufacture. About the time the present Scheme was established the subject of smokehouse design was investigated and proposals made which enabled considerable reductions to be made in the amount of firewood used for smoking. There have been numerous enquiries on this subject during the past year and a series of smokehouse plans, suitable for dealing with varying outputs, is at present being drawn up. Trials of a similar type of building for drying crepe with warm air have been made in view of the serious trouble with mould which occurs in many factories where the crepe is airdried. The experimental factory which is to be erected at Dartonfield will include a model smokehouse and crepe drying house and will enable sound methods of manufacture to be demonstrated to producers.

The most important problem facing rubber producers at the present time is to increase the consumption of rubber to bridge the gap between present world requirements and potential production. I have explained in a previous section that there are reasons in connection with the Ceylon industry for the continuation of agricultural research but having made provision for this it is essential that the resources of the Research Scheme should be directed to work tending to promote the increased utilisation of rubber. I have used the words "promoting the utilisation of rubber" in preference to the more popular expression "finding new uses" because they have a definitely wider significance. Research on the utilisation of rubber can be divided into two distinct branches.

1 DIRECT RESEARCH ON NEW USES

This type of research must usually be carried out by those in close touch with the requirements of the industries in which it is proposed to extend the use of rubber and it is therefore necessary, generally speaking, that such work should be done in the manufacturing centres of the world. This type of team-work research on new uses is being carried out on a large scale under the aegis of the New Uses Committee of the Rubber Growers' Association by Rubber Technologists working in conjunction with the Research Associations and individual manufacturers of the industries concerned, in relation to rubber roadways, rubber in paint, rubber in automobiles, rubber in the electrical, engineering and chemical trades, rubber in the printing trade, rubber resins, deodorisation of rubber etc. Information copies of reports on the investigations are received by the members of the Rubber Research Board.

2. The other branch of research on the utilisation of rubber relates to improvement of the properties of raw rubber with a view to providing a more suitable material for existing and new uses. The R.G.A. New Uses Committee has recognised that this is equally as important and profitable as direct "new uses" research in stimulating consumption.

One of the aims of this class of work is to provide a material which can be more easily manipulated by the Manufacturer and thus encourage the use of raw rubber in place of "reclaim" and other raw materials. The preparation of raw rubber in alternative forms such as ammoniated and concentrated latex, crumb and powdered rubber etc. is also within the scope of this branch of research.

While it has been made clear that research on "New Uses" can most profitably carried on in manufacturing centres, it is equally clear that work on the improvement of raw rubber and the provision of suitable grades for new uses must be dealt with by Research Associations in rubber producing countries, working in collaboration with those who know the requirements of users and can assess the suitability of new types of raw rubber for different purposes. The London Advisory Committee for Rubber Research (Ceylon and Malaya) has carried out research on the properties of raw rubber for some years and the R.G.A. New Uses Committee, in developing its campaign, has relied on the Advisory Committee to continue this work in conjunction with the Research Institutes in Ceylon and Malaya. The London Advisory Committee may be regarded as providing the necessary liaison between the two branches of research on the utilisation of rubber.

The general policy of the Research Scheme up to the present in promoting the utilisation of rubber has been to contribute (equally with the Rubber Research Institute of Malaya) to the expenditure of the London Advisory Committee and to co-operate in its work by providing samples of raw rubber prepared under conditions likely to result in improved properties, for trial at the Committee's laboratories at the Imperial Institute, London. The main lines of work carried out by the Committee relate to improvement of plasticity, the preparation of rubber in crumb form both by mechanical and chemical means, critical investigation of the claims made for "reclaim" as an alternative to raw rubber, concentration of latex by creaming and by evaporation etc. A number of patents arising from the work have been taken out in conjunction with the Rubber Producers' Research Association, in order to protect the processes concerned for the free use of the industry.

While research on the utilisation of rubber can be separated into the two branches referred to, these are not to be regarded as watertight compartments. For example the London Advisory Committee, while adhering to its general policy, has incidentally developed a relatively inexpensive type of rubber flooring and is trying to interest manufacturing firms in the product. There are also certain directions in which direct research on new uses can profitably be carried out in rubber producing countries. An example which is of special interest to Ceylon is the possibility of coir residues and other fibrous materials being successfully bonded with latex to form materials for flooring and other purposes. Other examples, on which work has already been carried out by the Research Scheme, are the preparation of self-vulcanizing crepe rubber by the addition of suitable chemicals to latex, and the treatment of jute hessian with vulcanized latex to provide an improved packing material for raw wool. In the latter case however, it is feared that the treatment would not prove profitable at the present price of rubber.

The Rubber Research Board decided last year to extend the scope of its "consumption" research by the appointment of an additional Chemist. Mr. M. W. Philpott, who has had valuable experience of similar work in England, was selected for the post and arrived in Ceylon in May. It is proposed that the Director of Research will continue to work on the improvement of raw rubber by modifications in methods of preparation and that Mr. Philpott will give his attention to such new applications of rubber as can suitably be investigated locally and to investigation of the scope for local manufacture of vulcanized goods, especially such as can be made direct from latex or are associated with the use of other local raw materials. He will be provided with a Laboratory at Dartonfield Estate, and space and equipment will be available in the experimental factory for large-scale trials of the processes concerned.

4. ADVISORY WORK

Advisory work forms an important feature of the Research Scheme's activities and, as I indicated in an earlier paragraph, is specially provided for in the Ordinance. Correspondence with estates and agencies during the past 2 years has averaged 60-70 letters per month and it is encouraging to note that Ceylonese Proprietors are making increasing use of the services of the Research Scheme in this direction. Advisory visits to estates are also made when required. Although this work occupies a material part of the technical staff's time it is a direct service to Producers which appears to be appreciated and enables close touch to be kept with the requirements and views of the industry.

Publicity is given to the work of the Research Scheme by means of an Annual Report and Quarterly Circulars, which are issued without charge to the Proprietors, Superintendents and Agents of local estates who apply for their names to be registered, such registration being renewable annually. At the present time approximately 300 estates are on our publications list, a figure which indicates that there are still many local Producers who do not receive the information made available by the Research Scheme.

There is one type of local Producer who is not in a position to benefit by the publications of the Research Scheme, namely the Small-holder or Peasant Proprietor. Broadly speaking it is correct to say that the small-holder will benefit equally in the long run with other classes of Producer from any improvement in the industry as a result of scientific research but it is desirable that measures should be taken to make information and advice available to the small-holder in a suitable form. This matter has not been overlooked by the Research Board but it has been necessary to postpone consideration until the lines of policy in other directions had been settled. I am authorized by the Chairman to say that proposals in regard to catering for the needs of the small-holder will be submitted to the Board for consideration in the near future.

In summarizing this paper I would say that the policy of the Research Scheme as at present defined is to maintain a balance between "production" and "consumption" research and that the requirements of the work are being catered for at Dartonfield Estate to the extent of the funds available.

NOTES ON THE YIELD PERFORMANCE OF BUDDED TREES OF PROVED CLONES IN COMMERCIAL PRACTICE*

IT is a fact that much of our evidence concerning the value of buddings of proved clones is based on the results of careful tapping and recording of individual yields of small numbers of trees. At the same time it must be emphasised that the character of uniformity within a single clone is of outstanding importance. Having once demonstrated that the high yielding property is possessed by every member of a very small group of trees derived by vegetative means from a single individual or mother tree then it is certain that this desirable property will be exhibited by all trees propagated from the same source. From the enquiries we have received and from conversations with estate managers in the course of advisory work the writer is convinced that this fundamental principle of vegetative propagation is not fully appreciated. As a result quite untenable arguments are still advanced against the principle and practice of budding in the commercial cultivation of Hevea.

There is no doubt that confusion has been created in many minds by the elimination of certain clones from the list of those recommended for planting. Although the reasons for rejecting clones, previously recommended for use, have always been clearly stated this has apparently failed to prevent the formation of quite erroneous impressions. It appears to have been assumed that a clone removed from the recommended list must have failed entirely in its capacity to give high yields. In no instance has this been true, rejection has always been decided upon after continued study of both the yield performance and the secondary characters such as susceptibility to disease, resistance to mechanical damage, character of bark renewal and the like. Though the high-yielding properties may be satisfactorily maintained the development of a secondary defect with increase in age of the buddings may justify the rejection of certain clones in favour of others which do not exhibit such undesirable secondary characters.

It should be apparent that the older budded areas in which certain clones were used which have now been rejected will not

* By C. E. T. Mann in the *Journal of the Rubber Research Institute of Malaya*, Vol. 5, No. 2, March, 1934.

necessarily prove unprofitable. In the early years at all events, their production will be in accordance with the early records of the first vegetative generation of the clones used. The defects, which we now know will become apparent with advancing age, can to a large extent be met by careful special treatment.

In view of the large number of enquiries we have received regarding the yields obtainable from commercial plantings of buddings of proved clones the following notes have been prepared.

The information presented is not exhaustive since the object of these notes is to present clear examples, taken from reliable sources, in order to indicate the level of the yield performance that may be reasonably expected from the modern budded plantation.

During the past year many estates in Malaya have carried out preliminary tapping tests on buddings of the older proved clones. The results have been very satisfactory; the yields obtained have agreed very closely with those recorded for the buddings of the first vegetative generation of the various clones. At the same time, these records of early tapping tests are of very little value in forming an estimate of the actual yield performance of the various clones under a recognised system of commercial tapping and it is for this reason that detailed reference is not made to the results in these notes. It is sufficient to state that, in no case reported to us, has the performance of a proved clone of undoubted authenticity fallen below expectations in the preliminary tapping tests. In Malaya the performance of several of the older proved clones, particularly the AVROS clones, has exceeded expectations in these preliminary tests. (See Table I).

TABLE I.

(i) Comparative yields of buddings of certain AVROS clones, and seedlings.

Yield per acre in pounds

Year	Age	Seedlings	Clone 71	Clone 80	Clone 152	Clone 163
1927	4½ yrs.	682	360	330	450	310
1928	5½ ,,	508	763	532	825	728
1929	6½ ,,	319	1126	779	1200	777
1930	7½ ,,	134	1327	1005	1494	1289

In the first 2 years of tapping, 1927-28, groups of 200 trees, *i.e.*, two plots of approximately 1 acre each, were recorded for each clone and for the seedlings. It was found that there was such close agreement between the yields of duplicated plots that after 1928 only one plot of each clone was recorded in detail, both seedling plots were recorded as before.

Trees were tapped on $\frac{1}{2}$ circumference daily in alternate months for the first year. Subsequently tapping has been on $\frac{1}{3}$ circumference daily in alternate months.

The estate on which this work was carried out was certainly above average as regards soil fertility and general upkeep. At the same time the figures are of considerable value since they show the relative performance of buddings of good proved clones and the best selected seedlings available at the time of planting. The general level of yield of buddings of good clones is so very much higher than that of seedlings that attention has been mainly centred on comparison between clones. There are no detailed figures, so far as we are aware, showing the comparison between seedlings, and buddings of such clones as BD.5. and Tjirandji I.

(2) In the accompanying Table II the actual yield records obtained in commercial tapping of budded areas on "X" estate are given. Unfortunately, no exactly comparable seedling areas were tapped for comparison but, from estate records, it is shown that the average yield of good seedling rubber on very similar soil is about 500 pounds per acre at maturity.

Block A contains 70 per cent. buddings of the 2nd class clones AVROS 33, 36, 52 and 80; 20 per cent. seedlings and false buddings; 10 per cent. of clones AVROS 49 and 50 which are now considered 1st class clones.

Block B contains 50 per cent. buddings of clones AVROS 49 and 50; 40 per cent. of 2nd class clones as above and 10 per cent. false buddings.

It should be clearly appreciated that, although the clones AVROS 33, 36, 52 and 80 are described as second class clones they are by no means useless or complete failures. This is clearly borne out by the actual yield figures recorded in the attached table. There appears to have been a good deal of misunderstanding on this point. Because a clone which has been recommended for use in the early days of budding is no longer recommended it is not correct to infer that the clone has

developed such defects that the buddings are now useless. At their worst, they are likely to be more productive than normal good seedlings. The correct inference is that selection work is still progressing and the oldest selections are constantly being improved upon.

In the accompanying table the yield for Block B shows that there is a reasonable expectation of reaching a yield of 900 to 1,000 pounds per acre in the 3rd year of commercial tapping.

TABLE II.

Yields from budded areas containing AVROS clones in mixed planting. Age at commencement of tapping 5 years.

Month of Tapping System:—Daily Tapping in alt. months.	Block A 110 acres Yield per Acre lb.	Block B 78 acres Yield per acre lb.
1930 1931		
December — January	33·3	37·4
February — March	32·9	41·7
April — May	52·6	52·3
June — July	55·2	64·8
August — September	68·5	77·7
October — November	56·4	77·7
Total pounds per acre.	298·9	351·6
1931 1932		
December — January	75·5	94·0
February — March	80·6	102·9
March — April	62·0	75·2
May — June	80·3	101·9
July — August	96·1	114·5
September— October	86·1	116·7
Total pounds per acre.	480·6	605·2
1932 1933		
November— December	91·7	112·6
January — February	109·1	138·2
March — April	122·4	153·6
May — June	94·9	111·0
Total to date (8 months) pounds per acre.	418·1	515·4

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the twenty-second meeting of the Board of Management, held in Room No. 211, New Secretariat, Colombo, at 10 a.m. on Thursday, July 19, 1934.

Present.—Dr. W. Youngman (in the chair), Messrs. C. H. Collins, C.C.S., (Deputy Financial Secretary), Leo B. de Mel, J.P., U.P.M., George E. de Silva, M.S.C., C. H. Z. Fernando, M.M.C., L. P. Gapp, F. H. Griffith, M.S.C., Col. T. G. Jayewardene, V.D., M.S.C., Messrs. J. L. Kotalawala, M.S.C., F. H. Layard, P. R. May, F. A. Obeyesekere, M.S.C., H. F. Parfitt, M.S.C., C. A. Pereira, B. M. Selwyn and Col. T. Y. Wright.

Mr. T. E. H. O'Brien, Director of Research, was also present by invitation.

1. MINUTES OF THE 21ST. MEETING OF THE BOARD

Draft minutes which had been circulated to members were confirmed after insertion of apology for absence received from Mr. B. F. de Silva and signed by the Chairman.

2. BOARD

The Chairman reported the following changes in membership since the last meeting:

1. Messrs. H. F. Parfitt and George E. de Silva to represent the State Council in place of Mr. E. C. Villiers, who had resigned, and Mr. H. R. Freeman, whose three-year period of office had expired.
2. Mr. C. H. Z. Fernando to represent the Low-country Products Association in place of Mr. F. A. Obeyesekere, who had completed his three-year period of office.
3. Mr. F. A. Obeyesekere to act for Mr. B. F. de Silva, who had been promoted to the Bench.

The Chairman welcomed new members to the Board and took the opportunity of thanking those who were retiring for their services.

3. DECISIONS BY CIRCULATION OF PAPERS

(a) *Oidium Leaf Disease.*—The Chairman reported that a memorandum on Oidium, prepared by the Mycologist, had been circulated to members and approved for publication. It was decided to publish the report in the *Quarterly Circular* together with a paper on the practical aspects of sulphur dusting and to have a large number of reprints prepared in pamphlet form in English and Sinhalese.

The Director of Research was instructed to prepare a memorandum, for consideration at the next meeting, submitting proposals for further work with special reference to the assistance of small-holders and the adequacy of the technical staff.

It was reported that the Tea Research Institute had arranged to carry out a series of trials in connection with the possibility of tea taints arising from sulphur dusting.

(b) The Chairman reported the appointment of the Director of Research to the Board of Assessors for budded Rubber and said that Mr. O'Brien had been given discretion to say if the work interfered unduly with his other duties.

(c) The Chairman explained that the report of the London Advisory Committee for 1933 had not been received when the Scheme's report was adopted. It had now been circulated to members and printed with the Scheme's report for 1933.

4. ACCOUNTS

(a) Statements of receipts and payments of the Board and of the London Advisory Committee for Rubber Research (Ceylon and Malaya) for the 1st quarter 1934 were adopted without comment.

(b) Accounts of Nivitigalakele and Dartonfield estate for April and May, 1934, were tabled.

5. LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA)

The Chairman reported that the contribution to the cost of the Committee's work, which had been agreed to, jointly with the Rubber Research Institute of Malaya, for a period of 3 years, would terminate at the end of 1934. The Committee had asked for the contribution to be extended for one year pending the consideration of a new scheme. He considered that the Board had had very useful service from the Committee and that a continuation of the grant would be of considerable advantage to the Scheme. He had ascertained by cable that the Rubber Research Institute of Malaya had decided to contribute for 1935.

After discussion it was decided that a vote of £1,400 be passed provisionally as contribution for 1935 and that full information be asked for regarding the proposed new scheme.

6. PROGRESS AT DARTONFIELD

(a) *Estate Committee.*—Minutes of meetings of the Estate Committee held on June 14th and 19th were considered. It was reported that the cart road to the factory site was opened for traffic on June 24th. The laboratory was to be completed by September 30th and the factory by October 27th. The minutes were adopted.

(b) *Contracts.*—It was reported that contracts for the factory and laboratory had been entered into with Messrs. Brown & Co., Ltd. and Messrs. Fonseka & Co. respectively. The documents were tabled for inspection.

(c) *Staff Bungalows.*—After discussion, the Estate Committee was authorised to proceed with the construction of a Superintendent's bungalow at a cost of Rs. 8,500/- and 4 Junior Staff bungalows at a cost of Rs. 4,000/- each, inclusive of water supply. The necessary additional votes were approved. It was also decided to provide a bungalow for the Assistant Chemist at a cost of Rs. 10,000/-.

(d) *Programme of Field Experiments.*—It was decided to defer consideration until the next meeting. The Director of Research reported that at present experimental work at Dartonfield was limited to the 7 acre replanting experiment.

7. LEASES AT CULLODEN AND NIVITIGALAKELE

The Chairman reported that the leases of building sites at Culloden would lapse at the end of 1934 but the Board had the option of renewal for a further 7 years. Renewal of the leases was approved.

8. STAFF

(a) A Committee consisting of Mr. C. H. Collins (Chairman), Mr. F. H. Layard and Mr. F. A. Obeyesekere with Mr. T. E. H. O'Brien as Secretary was appointed to consider the salaries, terms of service and future method of appointment of the junior officers of the Scheme.

(b) Three months' special leave of absence was granted to Mr. W. I. Pieris, Agricultural Assistant.

RUBBER RESEARCH SCHEME (CEYLON)

LIST OF PUBLICATIONS FOR SALE.

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No. 6. The Physiological Effects of Various Tapping Systems, Part II.
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No. 8. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part II.
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No. 14. On the Variation in the Number of Latex Vessels present in Hevea brasiliensis.
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No. 16. On the Natural Clotting of Rubber Latex.
No. 17. Vulcanization Tests.
No. 18. Measurements of "Bark Renewal."
No. 19. Vulcanization Tests.
No. 20. Do.
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No. 22. Do.
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No. 24. Do.
No. 25. Investigations on Samples of Plantation Para Rubber from Ceylon.
No. 26. Results of Trials of Ceylon Plantation Rubber for the manufacture of Ebonite.
No. 27. Investigations on Samples of Plantation Para Rubber from Ceylon.
No. 28. Do.
No. 29. Summary of the Principal Results obtained from Investigations into the Properties of Ceylon Plantation Rubber in relation to its Method of Preparation.
No. 30. The penetration of disinfectant on the tapping cut of Hevea brasiliensis.
No. 31. On the Occurrence of "Rust" on Sheet Rubber.
No. 32. On the Preservation of Latex.
No. 33. Investigations on Samples of Plantation Para Rubber from Ceylon.
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No. 36. Do.
No. 37. Do.
No. 38. Do.
No. 39. Do. (Final Report Series I.)
No. 40. Do Series II.
No. 41. Do. First Interim Report on artificial ageing tests.
No. 42. On the Smoking of Sheet Rubber in relation to Mould Prevention.
No. 43. The inter-relationship of Yield and the various Vegetative Characters in Hevea brasiliensis. (out of print).
No. 44. The Construction of Smokehouses for Small Rubber Estates. (out of date).
No. 45. The Efficiency of Disinfectants and Fungicides.
No. 46. The Control of Bark Rot by Disinfectants.
No. 47. Report on Variability of Ceylon Estate Grades.
No. 48. Brown Bast and its Treatment.
No. 49. Report on Causes of Variation in Plasticity.
No. 50. Crepe Rolling.
No. 51. The Curing of Sheet Rubber.
No. 52. The Preparation of Uniform Rubber.

Booklets at Rs. 2-50 per copy.

Guide to the Preparation of Plantation Rubber, by T. E. H. O'Brien, M.Sc., A.I.C., Chemist.

The Budding of Rubber, by R. A. Taylor, B.Sc., Physiological Botanist. (out of date).

Diseases of Rubber in Ceylon, by R. K. S. Murray, A.R.C.Sc., Mycologist.